

Abstract

A fuel processing method is operable to remove substantially all of the sulfur present in an undiluted hydrocarbon fuel stock supply which is used to power a fuel cell power plant in a mobile environment, such as an automobile, bus, truck, boat, or the like; or in a stationary environment. The power plant hydrogen fuel source can be gasoline, diesel fuel, or other like fuels which contain relatively high levels of organic sulfur compounds such as mercaptans, sulfides, disulfides, thiophenes and the like. The undiluted hydrocarbon fuel supply is passed through a nickel reactant desulfurizer bed wherein essentially all of the sulfur in the organic sulfur compounds reacts with the nickel reactant, and is converted to nickel sulfide, while the now desulfurized hydrocarbon fuel supply continues through the remainder of the fuel processing system. The method involves adding hydrogen to the fuel stream prior to the desulfurizing step. The method can be used to desulfurize either a liquid or a gaseous fuel stream. The addition of hydrogen serves to extend the useful life of the nickel reactant. The hydrogen can be derived from source of pure hydrogen gas, a recycle gas stream, or can be derived from an electrolysis cell which breaks down water produced in the fuel cell into its hydrogen and oxygen components. The hydrogen when added to the fuel stock serves to prevent or minimize carbon formation on the nickel reactant bed, thereby extending the useful life of the reactant bed, since carbon deposits tend to block active sites in the reactant bed.